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TECHNICAL MEMORANDUM

Evaluation of Co-Treatment of Stormwater and Sanitary Wastewater with Acid Mine Drainage

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DATE: May 12, 1999

This technical memorandum addresses the feasibility, advantages, and disadvantages of co-treatment of storm water and sanitary wastewater with acid mine drainage (AMD) in the Bunker Hill Central Treatment Plant (CTP). This technical memorandum has been prepared in support of the Presumptive Remedy process being undertaken by the EPA to develop a long-term management system for the Bunker Hill Mine AMD. This memorandum was prepared under Contract No. 68-W-98-228, Work Assignment No. 021-RI-CO-105G.

Background

Currently, all AMD from the Kellogg Tunnel is treated in the CTP, which was built by the Bunker Hill Company and initially placed into service in May 1974 and has not changed significantly since that time. The Central Treatment Plant (CTP) is configured as a standard high density sludge (HDS) plant. Lime is added to thickened sludge, which is then contacted with the plant influent in the neutralization/oxidation reactor. This reactor overflows to a polymer addition/flocculation chamber, which overflows to the thickener. The precipitated solids settle in the thickener and the clarified overflow flows into a polishing reservoir and into Bunker Creek. Excess solids are currently wasted each day into an unlined impoundment located on the Central Impoundment Area (CIA).

While the CTP produces an effluent that typically meets current permit limits, these limits are likely to be more stringent in the future. The EPA has drafted new Total Maximum Daily Loadings (TMDLs) for currently monitored metals (that is, zinc, cadmium, and lead) for the South Fork of the Coeur d'Alene River. The wasteload allocations for point sources are expected to result in much stricter new mass-based limits for discharges to the river. It is unlikely that without significant modifications the CTP can meet the more stringent limits resulting from the TMDL process.

Other local discharges into the South Fork of the Coeur d'Alene River will also be impacted by the proposed TMDL's. These include discharges from Publicly Owned Treatment Works (POTWs) and stormwater discharges. The purpose of this memorandum is to address the feasibility, advantages, and disadvantages of co-treatment of storm water and sanitary wastewater with acid mine drainage (AMD) in the Bunker Hill Central Treatment Plant.

There are three possible types of streams that could be treated in the CTP:

Untreated sanitary wastewater

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Final effluent from a POTW

Urban storm water run-off

The paragraphs below discuss each of these discharges.

Untreated Sanitary Wastewater

Untreated sanitary wastewater, or "raw" sewage, consists of residential wastes, including feces and urine, used shower and tub water, kitchen, and laundry discharges. Household cleaning chemicals and other materials used in the home could end up in the sewer. Raw wastewater also includes non-residential wastewater including that sewered from commercial and industrial facilities. Dilute water from roof drains and groundwater is also contributed especially in older sewer systems.

The primary constituents of concern include suspended solids, dissolved organics which consume oxygen, ammonia, and pathogenic bacteria and viruses. Heavy metals are present but typically at levels that aren't generally of concern. Many of the metals result from corrosion in the water piping and sewer systems.

Diverting raw sewage to the CTP for complete treatment is neither a practical nor a cost-effective option for the following reasons:

There is no mechanism (other than dilution and co-absorption on the hydroxide floc) to remove soluble organics (other than dilution and co-absorption on the hydroxide floc).

Disinfection of the entire CTP effluent would be required to assure that fecal coliforms criteria would be met.

The residuals from the CTP would be subject to the EPA 503 regulations. These regulations require the final sludge material to have a heavy metals content below established thresholds, which depend on the final disposal method. The sludge that will consist primarily of metal hydroxides would likely present a compliance issue with respect to these regulations.

The presence of sewage materials in the residuals represents a potential health threat, since there is no digestion or stabilization process to reduce the organic content or lower the pathogen levels.

Due to the organics, raw sewage could impair the precipitation process, causing the CTP removal efficiency to be less efficient.

There is no provision in the CTP to remove larger materials that are normally present in raw sewage, such as plastics, hair balls, condoms, tampons, and larger pieces of toilet tissue. A grinder or step screen will be required.

There is normally a certain amount of scum or flotables present in raw sewage, and the CTP currently has no provision to remove this type of material.

Unlike the AMD, there will be wide swings in the flow of sanitary sewage over the day. Flows will be higher in the 6AM to 8 AM period and again in the late afternoon and early evening. These swings may cause variability in the ratio of AMD to sewage and in the loading to the CTP.

There is potential for temperature swings to occur as well, which could impair chemical reactions and cause density gradients in the thickener.

There is a potential that co-treatment of AMD and sewage could result in odors, although the high pH of the treatment process would likely mitigate emissions.

In summary, for the above reasons, co-treatment of raw sewage in the CTP would greatly complicate the AMD treatment process and is not recommended.

Treated Sanitary Wastewater

A POTW will remove the majority of the constituents present in the sewage, leaving a final effluent that has only 5 to 10 percent of the suspended solids and organic materials (measured as 5-day biochemical oxygen demand). A good percentage of most heavy metals will be removed as well. Proper disinfection is required, which produces an effluent that, although not directly amenable for use as drinking water, has little or no adverse impact on public health or the environment.

It is conceivable that the final effluent could receive further polishing through the CTP. The possible consequences are as follows:

1. Refractory organics would be further removed, along with metals.

The remaining organics could adversely impact the precipitation process, causing the CTP removal efficiency to be less efficient, albeit to a lesser extent than the raw sewage.

There will be wide swings in the flow of sanitary sewage over the day. Flows will be higher in the 6AM to 8 AM period and again in the late afternoon and early evening. These swings may cause variability in the ratio of AMD to sewage and in the loading to the CTP. There is a potential for temperature swings to occur as well, which could impair chemical reactions and cause density gradients in the thickener.

While the co-treatment of POTW effluent would be easier to accommodate than raw sewage, it would be more prudent to maintain separate treatment systems for these waste streams.

Urban Stormwater Run-off

Run-off from City streets can contain anthropogenic heavy metals, as well as a host of other detrimental materials, such as oily material, fertilizers, pesticides, grit, sand, vegetative debris, and other materials. Typically, contaminant loading is the highest during the early part of a storm event, sometimes called the "first flush". After a prolonged rainfall contaminant loading diminishes significantly.

Although it is conceivable that storm water runoff could be treated through the CTP. The consequences are as follows:

1. Suspended materials, soluble metals, and some organics would be removed.

The organics and oil could adversely impact the precipitation process, causing the CTP removal efficiency to be less efficient.

There will be wide swings in the flow, which could adversely impact removal efficiency. There is a potential for temperature swings to occur as well, which could impair chemical reactions and cause density gradients in the thickener.

1. There is no provision in the CTP to remove larger materials that or normally present in storm water.

2. There is normally a certain amount of scum or flotables present in storm water, and the CTP currently has no provision to remove this type of material.

Although the co-treatment of urban storm water runoff and AMD has more merit than the treatment of raw sewage, it would be more prudent to maintain separate treatment systems for these waste streams.

Summary and Recommendations

Co-treatment of AMD with other wastewaters or storm water can cause diminished efficiency of the heavy metals removal processes. The magnitude of this decrease is a function of many parameters, including the percent contributed by the new streams. Under no circumstances is it advisable to have raw sewage co-treated with AMD unless considerable modifications are made to the mine water treatment plant. The required modifications would essentially consist of pre-treatment steps to produce a treated municipal sewage effluent prior to the AMD treatment plant.

Although it would be more feasible to perform co-treatment of treated municipal sewage effluent and stormwater than raw sewage. It is recommended that treatability testing be conducted if this is to be considered further. Also, the flow and characterization of these streams should be determined to calculate the relative percent contribution of these streams to the AMD treatment system.